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Trends Information Technology in E-Agriculture

: A Systematic Literature Review

Erick Fernando
Informatics Engineering
STIKOM Dinamika Bangsa
Jambi, Indonesia
erick.fernando_88@yahoo.com

Setiawan Assegaff
Information System
STIKOM Dinamika Bangsa
Jambi, Indonesia
setiawanassegaff@stikom-db.ac.id

Hetty Rohayani,AH
Computer System
STIKOM Dinamika Bangsa
Jambi, Indonesia
hetty_mna@yahoo.com

Abstract— ***ICT development is currently so fast, these developments affect the developing technology in all aspects, to the development of agriculture. Where the development of ICT transform traditional agriculture to modern. The purpose of this paper is to survey and analyze the available literature on Trend of information technology in E-agriculture and also to identify gaps and state-of-the-art in research. This study use the Systematic literature reviews study by collecting the article from reputable database journals. We used recognize database journal such as "Emerald", "Science Direct", "IEEE xplore", "Springer", "Saga Publication" and "Google Scholar" to collect the articles. "Information technology in E-agriculture" is used as a keyword to search the relevant article. The selected articles are reviewed and analyzed. The result of analysis that e-commerce is the Trend research in information technology in agriculture. That is famous study by researchers, e-commerce to agriculture requires good marketing processes and successful in order to impact income of farmers. In addition, researching the sensor area that help a process of agriculture to increase yields from such a farm. With the use of information technology trends is became agriculture more modern.***

Keywords: *Information Technology, Agriculture, Literature Review*

I. Introduction

In the era of information technology today, the role of the information technology sector has entered every aspect of human life. Information technology has recognize as a powerful tool in a wide range of activities carried out either organizations or individuals. So that information technology has affected, and occurs in most human activities.

Nowadays 'information technology' (IT) has become a very important agenda in various sector, example in the sector agriculture. It is believed that IT can produce a competitive advantage for the user who implement it. Where the advantages of the kompettitif IT can build a better and successful in the agricultural sector

Since information technology became critical infrastructure in the agricultural sector, study in this topic is became main research focus for researchers and practitioners in the field of IT and agricultural.

The aim is to establish the background for further studies and gain a deeper insight about the topic. The complexity of the research use of technology in the agricultural building has been cited in many sources. the development of these technologies makes the motivation to know what technology trend that is widely used in agriculutre. Here we found 21 articles that examined the use of technology in agriculture. Overall this paper we have analyzed it can be a question that will be answered in this study include:

RQ1. What research focuses on the trend in the technology used?
RQ2. How many country to publications trend in agriculutre?
RQ3. How many research topics of agriculture each country?

The results of this study provide a comprehensive approach to research in technology trends and implications and guidelines for scholars and practitioners. This paper described as follows: to explain some of the technology used, methods of applied research, including research questions, measures of search, the forum selected publications, classify, process and classification scheme is illustrated. The results of the mapping study discussed

II. Literature Review

A. E-Agriculture

Electronic agriculture (E-Agr) is an approach to promoting agricultural informationalization and development agricultural modernization. It is a platform that provides sharing of information for farmers. Science and technology could enhanced agricultural information became more accurate, timely, authoritative and in particular take advantage of timeliness, convenience, etc. The modern information technology infrastructure facilitate the integration all types of information and resources through technical facilities of modern networks, communication tools, etc. E-Agr mainly includes the rural electronics, electronic farmers and agricultural electronics [1].

B. IT in Agriculture

Advances in information technology encourage stakeholders to adopt more automation in the businesses process. Modern process automation has been influenced by information technology in the agricultural sector. Some of the activities of process automation in this sector is a soil sampling and variable-level fertilization (VRF), field and mapping results, scouting crops, harvesting, data management traceability, systems implementation and application [2].

Application of IT in agriculture makes this sector to be successful in its development. All of this caused that IT is very helpful all the processes carried out in the farm management process starting from soil preparation, planting, irrigation,

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management pest, until harvest. IT used include Decision support system, Sensor, data inventory, GIS, expert systems. After the last of the harvest process, IT plays a role also in the marketing of agricultural crops that use e-commerce. E-commerce may increase in the sale of agricultural products to every place

C. *E-commerce*

Electronic commerce is a powerful concept and process that has fundamentally changed the flow of human life. Electronic commerce is one of the main criteria of the revolution of information technology and communications in economics. E-commerce has been widely use and bring much benefit for human life, in addition this concept also eliminanted some problem occurs in traditional business [3],[5].

E-commerce is widely considered as purchase and sale of products via the internet, but which completed transaction only through electronic measures can be considered e-commerce. E-commerce is divided into three categories: business-to-business or B2B, business-to-consumer or B2C, and consumer-to-consumer or C2C. also called as electronic commerce[4]

D. *Geografis Information System (GIS)*

GIS is used as a decision-making tool for the analysis of the suitability mapping from the places and for developmental activities using mapping an area[6]. Land use suitability mapping and its analysis is one of the most Integration of GIS. GIS technology provides the capability of spatial data and network systems for the representation of real data in producing of various types of maps. The advantage of the GIS model is that it produces several maps while representing real route networks in order to reach markets in the quickest time possible.[7]

III. Research Method

The method used in this study is the Systematic literature reviews (SLR). SLR is a method to identify, evaluate, and construe all available and relevant literature related to the research question interesting[8].We use keyword "electronic agriculture", "information technology and agriculture" to collected articles from Reputable database journal. Reputable dataset journal was we use in search article relevan to ours research topics including "Emerald", "Science Direct", "IEEEexlpore", "Spinger", "Saga Publication" and "Google Scolar". We collected seventy articles, after reviewing the article's we selected twenty one relevant articles. We analyzing on the articles that has been selected and the result was described as a finding in the discussion.

No	Research Question	Desciption
RQ1	What research focuses on the trend in the technology used?	Describes the trend research a technology application in agriculture
RQ2	How many country to publications trend in agriculutre ?	Describe many of its countries are conducting research in the agriculture sector technology application
RQ3	How many research topics of agriculture each country?	Describe the many research topics that carry out the implementation of technology in the agricultural sector

IV. Results and Analysis

Ninethy article was collected from the reputable journal, after peform selection twenty one articles was relevan for futher analysis. Table 1 is summuraize all of therty articles that meet our criteria.

Table 1 : Tabel is summuraize all of twenty one articles that meet our criteria

Tahun	Author	Title	Topic
2009	Guan Hai-ling,Chen Jian-cheng, Liu Xiao-yong	The Agricultural Product's Trade Mode in Electronic Commerce Environment	e-commerce
2010	Zhang Chunhua, Zhang Bo	Bottleneck Problems in China's E-Agr Development	Promotion
2015	Veronique Bellon-Maurel, Gregory M. Peters, Sonia Clermidy, Gustavo Frizarin, Carole Sinfort,Heman Ojeda, Philippe Roux, Michael D. Short	Streamlining life cycle inventory data generation in agriculture using traceability data and information and communication technologiese part II: application to viticulture	Data inventory
2012	Hua [illegible]ng,Shanzhen Yi, Yonggang Wu	Decision Support System and Monitoring of Eco-Agriculture Based on WebGIS in Shule Basin	DSS
2010	Jun Kang, Lecai Cai, Hongchan Li	The Development Model Electronic Commerce of Regional Agriculture	e-commerce
2010	Zhuang Weidong, Wang Chun, Han Jing	Development of Agriculture Machinery Aided Guidance System Based on GPS and GIS	GIS
2015	Santoshkumar, Udaykumar	Development of WSN System for Precision [illegible]riculture	sensor
2014	ZHAO Ze-long TIAN Yu	Discussion about Agricultural E-commerce [illegible]ation and Optimization	e-commerce
2012	Xiaoxiao Li,Jing Li, Sheng Dai, Chong Shen	Electronic Commerce And Supervision Platform In Agriculture Based On Web 3.0	e-commerce
1987	S.W. R. Cox, QBE, BSc, CPhys, FInstP, [illegible]grE	Electronics in UK agriculture and horticulture	sensor
2014	Pradipta Biswas Jaya Umadikar Patrick, M. Langdon,Arti Kashyap, and Suma Prashant	Exploiting Inclusive User Model for an Electronic Agriculture System	expert systems
2012	Benoit A. Aubert a, Andreas Schroeder , Jonathan Grimaudo	IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology	GIS, Sensor

2013	Ben Uwadum Ugwoke	Promoting Nigerian agriculture through library and information services	Promotion
2013	Abhijit Suprem,Nitaigour Mahalik, Kiseon	A review on application of technology systems, standards and interfaces for [illegible]culture and food sector	sensor
2015	Ciprian-Radu RAD,Olimpiu HANCU, Ioana-Alexandra TAKACS,Gheorghe [illegible]TEANU	Smart Monitoring of Potato Crop: A Cyber-Physical System Architecture Model in the Field of Precision Agriculture	DSS
2012	M.L.G. Polpitiya, G.R. Raban, W.K.S.S. Prasanna wksudeera, D.T.S. Perera, startharusha, D.P. Chandima chandima, U.K.D.L. [illegible]watta	Wireless Agricultural Sensor Network (A low cost wireless sensor network to monitor an agricultural space)	sensor
2015	Tamoghna Ojha , Sudip Misra , Narendra Singh Raghuwanshi	Wireless sensor networks for agriculture: The state-of-the-art in practice and future challenges	sensor
2009	LILiping, Xue Wei	Study on the supply chain management of Agriculture Product under E-commerce Environment	E-commerce
2009	Rouzbeh Meymandpour, Mohammad Amin Mousavinezhad, Mohammad Hadi Sadreddini	The Economic Impacts of Electronic Marketplaces in Globalization Age Examples From Agricultural Web Portals	E-commerce
2010	P. P. JAMBHULKAR, AND MURLIDHARSAD AWARTI	Information Technology in Plant Protection	DSS
2015	M Culman, C D Guerrero, J Viñuela, J Torres and F Almenarez	A review of Wireless Sensor Networks for crop field monitoring and considerations for its application in Colombian agriculture	sensor

This diagram below illustrates the sequence of information technology trends summarized twenty-one articles in the field of agriculture which is referenced in this study. shown in Figure1.

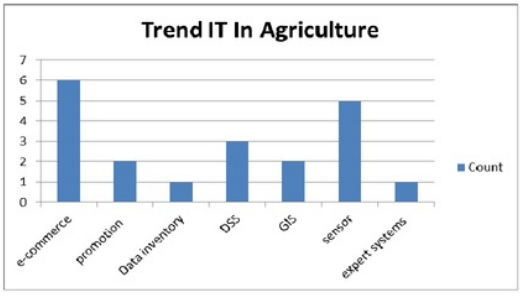

Figure1. Trend IT in agriculture base topic

The grouping from IT trend in agriculture is the E-commerce. E-commerce which explains the importance of how crops can be marketed well and sensors that help the agricultural process that becomes more effective and effesien. Thus agriculture to be successful in changing traditional farming become modern.

Table 2 : Tabel is summuraize all of twenty one articles that meet author base on country

Country	author	Count
China	Guan Hai-ling et all , Zhang Chun hua et all, Hua zhang et all, Jun Kang et all, Zhuang Weidong et ll, Zhao Ze long dan Tian Yu , xiao Li et all, Liliphing,	8
UK	Cox et all, Pradipta Biswas Jaya Umadikar Patrick et all, Benoit A Aubert et all	3
US	Abhijit et all	1
India	Santoshkumar et all, Tamoghna Ojha et all, P.P Jambhulkar et all	3
Nigeria	Ben Uwadum	1
Romania	Ciprian-radu Rad et all	1
Srilangka	M.L.G Polpitiya et all	1
Iran	Rauzbeth Meymandpour et all	1
Australia	Veronique Bellon-Maurel et all	1
Columbia	M.Culman et all	1

China is a country that does the most research in the field of agriculture in recent years. china conduct research in various research topics include: Information Communicatiaon Technology, Sensors, GIS, E-commerce, and other sectors. Research carried out to support all activities that occur in agriculture. in addition to china existing some countries such as India, America, and Britain who also did a lot of research in the area of agriculture. shown in Figure 2

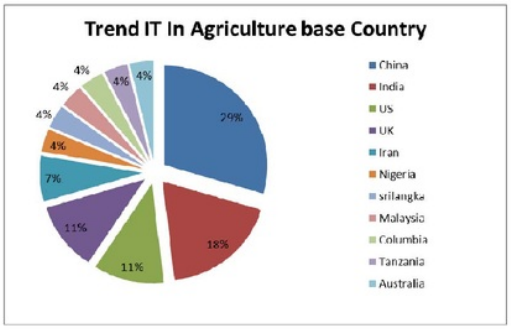

Figure2. Trend IT in agriculture base country

TABLE 3 : TABEL IS SUMMURAIZE ALL OF TWENTY ONE ARTICLES THAT MEET COUNTRY BASE ON TOPIC RESEARCH

Topic \ country	China	UK	US	India	Nigeria	Romania	Srilangka	Iran	Australia	Columbia
sensor	-	2	1	2	-	-	1	-	-	1
e-commerce	5	-	-	-	-	-	-	1	-	-
Promotion	1	-	-	-	1	-	-	-	-	-
GIS	1	1	-	-	-	-	-	-	-	-
DSS	1	-	-	1	-	1	-	-	-	-
expert systems	-	1	-	-	-	-	-	-	-	-
Data inventory	-	-	-	-	-	-	-	-	1	-

CONCLUSION AND ACKNOWLEDGMENT

Information technology has provided an opportunity to change the traditional agriculture become modern agriculture. In the use of information technology in the agricultural process from the beginning to the end gives a good effect so that a agriculture to be successful. This study reveals that e-commerce and sensor as most technology has become trend in e-agriculture implementation. Developments in agricultural technology research is mostly done country of China. The research that they develop from an agriculture process which can increase agricultural output to how agriculture can have a better marketing. Our next agenda is to develop a framework that mapping agriculture activities with the potential information techology could applying in enhanced agriculture process activities.

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